LSP Advisory Role for ISS Commercial Resupply Services Back-Up Charts

Evaluation Factors from the RFP

Generic Service Features

Applicable and Reference Documents

Data Requirements Descriptions for LSP Insight

Statement of Work for Reviews and Insight

Contractual Insight Clause

Data Requirements Descriptions for Optional Insight

NPD 8610 Applicability by Line Item

RELATIVE ORDER OF IMPORTANCE OF EVALUATION FACTORS

- **Mission Suitability is more important than Price.**

MISSION SUITABILITY FACTOR WEIGHTINGS AND SCORING

- **The Mission Suitability factor will be weighted and scored on a 1000 point scale.**
- **The weights (points) associated with each Mission Suitability subfactor are as follows:**

		Points
Subfactor A – Technical Approach		550
Subfactor B – Management Plan		400
Subfactor C – Small Business Utilization		50
Small Business	25	
Small Disadvantaged Business	25	
	Total	1000

Mission Suitability Definitions

- **91% – 100%, Excellent: A comprehensive and thorough proposal of exceptional merit with one or more significant strengths. No deficiency or significant weakness exists.**
- **71% – 90%, Very Good: A proposal having no deficiency and which demonstrates over-all competence. One or more significant strengths have been found, and strengths outbalance any weaknesses that exist.**
- **51% – 70%, Good: A proposal having no deficiency and which shows a reasonably sound response. There may be strengths or weaknesses, or both. As a whole, weaknesses not off-set by strengths do not significantly detract from the offeror's response.**
- **31% – 50%, Fair: A proposal having no deficiency and which has one or more weaknesses. Weaknesses outbalance any strengths.**
- **0% – 30%, Poor: A proposal that has one or more deficiencies or significant weaknesses that demonstrate a lack of overall competence or would require a major proposal revision to correct.**

The technical subfactors will be evaluated for the effectiveness, clarity, comprehension, feasibility, realism, suitability, risk and soundness.

T1.System Capabilities and Summary of Performance

- **NASA will evaluate the offeror's capability to meet NASA's needs as stated in the SOW. This will include the level of development maturity of those capabilities; the production and annual delivery capability, and processing lead times; the approach to meeting the task order demand including Work Plans; and the offeror's understanding of the scope, content, and complexity of the resources required to perform the service.**

T2.ISS Integration and Demonstration

- **NASA will evaluate how the offeror's schedule and planning for ISS integration will impact the delivery of services under this contract. NASA will use the ISS Integration milestones and plans to evaluate schedule and technical risks in the performance of the offeror's proposed tasks.**

T3.ISS Resupply Mission Performance Plan

- **NASA will evaluate the technical feasibility of the offeror's approach for the delivery of services as reflected in the MIOMP (DRD C1-7). NASA will evaluate the offeror's understanding of the key reviews, products, and mission requirements as described in the SOW. NASA will evaluate the ability of the offeror to provide the services within the contract period.**

T4.Risks

- **NASA will evaluate the offeror's understanding of the risks of providing the ISS resupply services, completeness in identifying risks, and the appropriateness of their mitigation plans.**

The management subfactors will be evaluated for the effectiveness, clarity, comprehension, feasibility, realism, suitability, risk and soundness.

M1. Company Information

- **NASA will evaluate the offeror's proposed management team for key positions; the teaming arrangements and completeness in meeting the key aspects of the SOW; and the overall effectiveness and completeness of the management approach, plan, and processes. Exhibit 4 will be evaluated as part of the Management Approach subfactors.**

M2. Performance Milestones

- **NASA will evaluate the offeror's proposed milestones for compliance with the limitations in Clause II.A.6, and the overall risk that the payment schedule provides to NASA. An example of what would be viewed as a high Government risk would be a payment scenario where a high percentage of the financing payments were prior to the successful demonstration of a critical new technology, or where payments were not tied to key mission development or production milestones.**

M3. Safety and Mission Assurance

- **NASA will evaluate the offeror's approach for safety (range, ground, flight, etc.), reliability, maintainability, supportability, quality, software assurance, and risk management for completeness and effectiveness at meeting the contract requirements. NASA will also assess the completeness of the provided Safety and Health Plan (Attachment V.E), per Provision VI.A.8, and Mishap Notification, Investigation and Contingency Action Plan (DRD C1-2).**
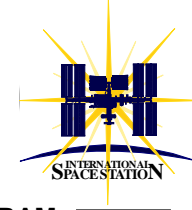
- **Each contractor has its own launch and mission control facilities.**
- **Late stow cargo is packed at L-24 hours.**
- **Early destow cargo is unpacked within Landing+6 hours.**
- **Station Inventory Management System is used.**
- **Range safety data package may also be useful to LSP insight.**
- **"ISS Integration: the activities required to ensure that SSP 50808 requirements have been met; necessary hardware and software development to interface with the ISS has been completed; and joint on-orbit integrated operations plans have been finalized."**

- **49 U.S.C. Subtitle IX, Ch. 70, Commercial Space Launch Activities**
- **14 C.F.R. Ch. III, FAA Commercial Space Transportation Regulations**
- **AS9100B, Aerospace Quality Management Systems Requirements**
- **ISO 90003:2004, Software Engineering – Guidelines for the Application of ISO 9001:2000 to Computer Software**
- **NPR 1600.1 Rev.1, NPR for Security Programs**
- **NPR 2810.1A, Security of Information Technology**
- **NPR 8715.6, NPR for Limiting Orbital Debris**
- **SN-C-0005D, Space Shuttle Contamination Control Requirements**

Reference Documents

- **NPR 8621.1B, Mishap and Close Call Reporting, Investigating and Recordkeeping**
- **NPR 8715.3C, NASA General Safety Requirements**
- **NASA-STD 8739.8 Rev.1, Software Assurance Standard**

DESCRIPTION/PURPOSE:

- **This item covers the submission of System Safety-related data required to be delivered to the applicable Federal or Range Safety Organizations. This includes United States Air Force (USAF) Eastern, Western Range, Kwajalein, Kodiak Island, Wallops Island, Commercial, and International ranges. Contactor shall submit copies of all Federal or range-required documentation to NASA.**

DATA REQUIREMENTS

- **Contactor shall submit copies of all Federal or range safety-required documentation to NASA. Time of submission shall be as specified in the applicable Federal or range safety requirements.**

- **Submittals shall also include all agreements, determinations, interpretations, waivers, deviations, mishaps and close calls obtained with and/or delivered to any Federal or Range Safety Organizations: Eastern, Western, Kwajalein, Kodiak Island, Wallops Island, Commercial, International ranges or any other ranges.**

DRD: LV Flight Software Input for IV&V

DESCRIPTION/PURPOSE:

- Assessments consist primarily of documentation and data review by the NASA flight software team. The focus is on technical adequacy and robustness to support mission success consistent with risk posture. Evaluation criteria are based on prior independent verification and validation (IV&V) efforts, NASA standards and industry practices.
  - Allocation of roles and responsibilities of groups.
  - Established system configuration, capability, and constraints.
  - Internal and external compatibility.
  - Established software processing capabilities and constraints.
  - Completeness and testable requirements.
  - Adherence to coding standards and verify design to code conformance.
  - Hardware in the loop test facilities capability, test plan, data management process, and run review approach.
  - Accurate delivery for flight use.
  - Scope of development tool use and potential risk points.

DATA REQUIREMENTS:

- Organization documents – Org chart, product team, software quality assurance (SQA), Office of the Chief Engineer (OCE), and analysis role and responsibility documents.
- Vehicle system description – Vehicle overview, Avionics component ICDs, flight computer specification.
- Development process – Software development plan and process, change review board charter, and change tracking data base.
- Requirements documents and data base reports – System and derived requirements documents. Tracking data base. Requirements to design and test trace matrices, but NASA can generate the trace products independently if need be.
- Design assessment – Program flow diagrams or equivalent. Algorithm derivation documents. Source code table top review.
- Implementation – As built code products include unit testing plan and results, build scripts, compiler options file, build library description.
- Qualification test – system integration lab (SIL) test facilities capability documentation, test plan, data management plan, test review process, requirements to test closure, data if specific areas of concern are found.
- Release process – Configuration management plan, pedigree review plan, media release process.
- Development Tools – Input parameter processing and code generation scripts.
- Models – Simulation code used for developmental test.
- Kickoff, Midterm and Close-out technical interchange meetings (TIMs) sessions may be scheduled with the Contractor team to answer questions.

DRD: LV GNC Input for IV&V

DESCRIPTION/PURPOSE:

- NASA will perform independent analyses to assess adequacy and robustness of the Contractor's GN&C design and compare with Contractor's GN&C analysis results and flight data, if vehicle has flown. Independent vehicle model will be built using NASA's Universal Controls Analysis Tool (UCAT). NASA will perform nominal and dispersed linear stability analyses to assess adequacy of autopilot stability margins. Analysis will include effects of aerodynamics, bending, propellant slosh, and actuator and sensor dynamics. NASA will also perform Nonlinear GN&C Simulation Analysis. This includes nominal and dispersed nonlinear time-domain simulations to assess robustness of GN&C design, including gimbal margins, consumables margins, and injection accuracy. Analysis will include effects of aerodynamics, bending, propellant slosh, actuator and sensor dynamics, and winds.

- Flight software model can incorporate contractor's flight software code directly (preferred) or a model can be built using contractor's flight software algorithm description documentation. Analyses will be performed for a selected mission which may or may not have been previously flown, but for which Contractor analysis results are available. Data can be provided in formats already used by contractor. NASA has been able to convert data in their native form from several contractors.

DATA REQUIREMENTS:

- Flight software code and/or flight software documentation (preferred), if not provided above. NASA can also build a model using contractor's flight software algorithm description documentation.
- Flight software parameters
- Vehicle characteristics
    - Propulsion characteristics
    - Aerodynamics parameters
    - Mass properties
    - Bending mode parameters
    - Propellant slosh characteristics (or tank geometry description)
    - GN&C sensor and actuator dynamics parameters
- Flight data, if selected mission has flown. Data, in nearly all cases, can be transmitted electronically and in formats already in use by the contractor.
- Contractor linear stability and nonlinear simulation analysis results and reports.
- 2 or 3 TIMs with Contractor GN&C analysts as needed for NASA understanding of contractor-provided data and analysis results. These meetings will occur approximately every 3-4 months over the course of about a year.

DESCRIPTION/PURPOSE:

- **The Contractor shall provide qualification rationale and data for Propulsion, Flight Controls and Separation systems, subsystems and components. The Contractor shall provide systems and component specifications. This evidence demonstrates the components and systems were tested in a manner consistent with how they will be used in flight, have sufficient margin to their maximum expected environments and to their minimum required performance.**

DATA REQUIREMENTS:

- **Component and systems specifications (design requirements documents) for Propulsion, Flight Controls and Separation.**

- **Test Readiness Review packages**

- **Rationale and data would typically be formal qualification test plans and reports if the methods and results are clearly enumerated. Test apparatus configuration drawings and schematics are also. If formal reports do not exist, the Contractor may provide copies of procedures and data sheets. Test deviations, anomalies and their resolutions shall also be provided.**

DRD: Preliminary Post Flight Assessment

DESCRIPTION/PURPOSE:

- After each launch, a preliminary post-flight report shall be provided that addresses Mission Success Criteria. Sufficient detail and evidence shall be provided for NASA to make a Mission Success Determination. This report shall provide an initial post-flight summary of the performance of the launch and orbital vehicles. Preliminary notification and investigation status of any anomalies cited to this point shall be provided in the report.

DATA REQUIREMENTS:

- Full-rate flight data in accordance with the instrumentation plan in the Vehicle IDD (DRD C3-1) and SOW Section 2.2.2.
- Complete full-rate telemetry stream for launch vehicle systems.
- Contractor's Flight or Launch Readiness Review package
- Pre-flight prediction of
  - expected flight environments (i.e., acoustic/vibration, quasi-static acceleration, thermal, and pressure)
  - 6-degree of freedom (DOF) trajectory simulation and its inputs, nominal and 3-sigma orbit elements, performance, margins, reserves, sequence of events and tracking
  - Generic vehicle environmental data may be submitted unless mission unique environmental requirements are identified in the ICD
- Presentation and analysis of the Mission Success Criteria, which are determined in accordance with Clause II.A.19 Mission Success Determination, Investigation, and Corrective Actions at the Cargo Integration Review.

DESCRIPTION/PURPOSE:

- After each launch, a final post-flight report shall be provided. This report shall provide a comprehensive post-flight summary of the performance of the launch and orbital vehicles. This report will support the NASA Contracting Officer's mission success determination.
- This requirement shall also apply to utilization of the launch vehicle fleet or delivery vehicle fleet on non-NASA missions.

DATA REQUIREMENTS:

- After each mission, this report shall be provided the following data as it pertains to the launch and orbital vehicles:
- Contractor's post flight report, including predicted and actual vehicle system, subsystem and component performance data
- Post flight determination of actual flight environments
- Explanation of significant differences between the predicted and actual flight environments
- When applicable, accident investigation and resolution documentation, responses and implementations to the mishap board's recommendations and return to flight activities
- Identify problems, anomalies and malfunctions over the course of the mission and their impact on the payload and the overall mission.
- Provide recommended corrective actions and anomaly resolutions. This would include model and predicted environment updates due to collected flight data.
- Assess the adequacy of training, both for flight and ground personnel

At not later than L-18 months, the Contractor shall allow NASA to participate in a Contractor review that establishes the integrated mission vehicle configuration (launch vehicle and orbital vehicle). The intent of the VBR is to establish the baseline vehicle for the mission and identify any design changes from the previous mission vehicle and the corresponding plans for executing and verifying these changes.

MISSION BASELINE VEHICLE

- **The Contractor shall, at this review:**
  - **Establish a baseline launch and orbital vehicle configuration so that subsequent mission integration efforts have definite launch and orbital environments and performance capabilities identified.**
  - **With NASA approval, reconfirm the 90-day delivery window.**
  - **Provide the instrumentation plan as defined in the Vehicle IDD (DRD C3-1).**

DESIGN CHANGES FROM PRIOR MISSION BASELINE VEHICLE

- **The Contractor shall also, at this review, identify any design changes from the previous mission baseline vehicle (launch and orbital vehicle).**
- **For the orbital vehicle, the Contractor shall:**
  - **Identify all SSP 50808 requirements that are impacted by the change and show how the have been allocated to the appropriate system, subsystem and/or component level. Also show how the requirements flow down is adequate to verify compliance with SSP 50808.**
  - **Discuss analyses and tests performed to execute these design changes and include their methodology, assumptions and results, along with comparisons to any similar proven designs.**
  - **Show how these changes affect performance, reliability and environments.**
  - **Present the status or results of any mission unique or special study task assessments requested by NASA for complex manifest options.**
  - **Provide a schedule to complete all work required to accomplish the design changes and close requirement verifications prior to CIR.**

For the launch vehicle, the Contractor shall:

- **Identify mission unique changes and first flight items. Discuss analyses performed to execute these design changes and include their methodology, assumptions and results, along with comparisons to any similar proven designs. Show how these changes affect performance, reliability and environments.**

- **Provide updates to DRD C3-5 when qualification margins in those systems decrease or new qualification tests are executed.**

- **All system requirements are appropriate and have been allocated to the subsystem and component level and the flow down is adequate to verify system performance.**

- **The design solutions to be implemented are expected to meet the performance and functional requirements with applicable and acceptable margins.**

- **The design does not pose major problems that may cause schedule delays.**

- **Overall system architecture has been established.**

- **The design solution can be produced based on existing processes and techniques; if not, risk areas, which require unique and unproven processes, are identified and risk mitigation plans are established.**

- **An acceptable operations concept has been developed.**

- **Preliminary plans are established for end-to-end testing methodologies.**

SOW: Mission Integration Review

At not later than L-13 months, the Contractor shall allow NASA to participate in a review that provides NASA with a current mission integration status. NASA will utilize the information presented at this review to determine if the planned delivery date is achievable and if integration efforts should continue.

MISSION BASELINE VEHICLE

- **The Contractor shall, at this review:**
  - **Establish a 30 day window for cargo delivery to ISS.**
  - **Provide updates to the instrumentation plan as defined in the Vehicle IDD (DRD C3-1).**
  - **Provide initial data and parameters for Mission Success Determination.**
  - **Present the external cargo carrier layout for approval by NASA, if applicable.**

DESIGN CHANGES FROM PRIOR MISSION BASELINE VEHICLE

- **For the orbital vehicle, the Contractor shall:**
  - **Present designs and their supporting analyses that implement mission unique requirements.**
  - **Present progress in manufacturing and lay out remaining milestones and risks to accomplishing them.**
  - **Present progress in ISS integration, including progress toward closure of SSP 50808 requirements, and lay out remaining milestones and risks to accomplishing them.**
  - **Present progress of ISS integrated safety hazard assessments. Integrated safety analysis identifying any remaining hazards and proposed resolution per Section 2.5.2, Safety Assessments.**
- **For the launch vehicle, the Contractor shall demonstrate the following to NASA:**
  - **Designs and their supporting analyses that implement mission unique requirements.**
  - **Progress in manufacturing and lay out remaining milestones and risks to accomplishing them.**
  - **Technical problems and design anomalies have been resolved and effects of design changes on system performance, reliability and safety have been identified.**
  - **The detailed design will meet performance, functional requirements, and schedule.**
  - **Software simulations and prototyping results do not present any potential mission risks.**
  - **Test plans have been defined.**

At not later than L-4 months, the Contractor shall allow NASA to participate in a review that allows NASA to assess if the Contractor will be ready for NASA cargo turnover at L-3 months. A status of all open items presented in both the **VBR** and **MIR** shall be presented at this review. All mission unique design qualification and acceptance testing, unless no-test factors of safety are used, shall have been accomplished. For open items, low schedule risk plans for completion shall be presented. All milestones to this point shall have been met.

The Contractor shall, at this review:

- **With NASA, mutually agree on a delivery window of 14 days.**
- **Provide the final instrumentation plan as defined in the Vehicle IDD (DRD C3-1).**
- **Present evidence of verification closures for mission unique designs and requirements.**
- **Present evidence of verification closures for all open SSP 50808 requirements.**
- **Provide all analytical assessments that show the compatibility of NASA cargo with the launch and orbital vehicle such as integrated loads, Launch to Activation thermal assessments, electromagnetic interference (EMI), and power.**
- **Present evidence that all Safety Assessments have been approved by NASA.**
- **Provide final data and parameters for mission success determination.**
- **The Demonstration mission shall be complete prior to the first CIR. The post-flight data review shall be complete; and all anomalies are identified with corrective actions and low-risk closure plans in place.**

- **The Contractor shall establish, implement, and maintain comprehensive safety and health, reliability and quality assurance programs covering program management, mission integration management, and the design, development, production, test, integration, launch and flight of the cargo delivery system.**
- **The Contractor shall operate its vehicles in accordance with NPR 8715.6, NPR for Limiting Orbital Debris.**

RISK MANAGEMENT

- **The Contractor shall implement risk management techniques that address the identification, analysis, mitigation, and tracking of potential impacts to safety or mission success. The Contractor shall develop the criteria, methods, and procedures used for identifying critical items.**

GROUND SAFETY REVIEWS

- **If required by the ground site, the Contractor shall develop and deliver integrated ground safety data packages and participate in ground safety reviews per launch or processing site requirements. The Contractor shall provide and update, for flight hardware ground operations and GSE, a Safety Data Package to the appropriate authority in support of each mission and provide a copy to NASA (DRD C1-10).**

SAFETY AND HEALTH PROGRAM

- **The Contractor's Safety Program shall ensure compliance with federal, state, and local government regulations as applied at the places of performance and as enforced in facility usage agreements. In addition, when the Contractor is performing work in any NASA-owned or controlled facility, all NASA requirements and documentation (NPR 8715.3, NASA General Safety Requirements, tailored) shall be adhered to.**
- **Each Contractor employee on NASA-owned property, or custodian of NASA assets elsewhere to the extent those assets are involved, shall report mishaps or close calls according to the Contractor's Mishap Notification, Investigation and Contingency Action Plan (DRD C1-2).**

- **The Contractor shall implement a quality assurance program that meets pertinent NASA and industry standards as described below.**

QUALITY ASSURANCE MANAGEMENT

- **The Contractor shall maintain a quality management system that is AS9100 compliant. The Contractor shall allow NASA participation in Contractor and subcontractor compliance and internal audits upon request. NASA insight will consist of monitoring NASA-selected audits with the Contractor's auditors and inspectors in order to provide understanding of the Contractor's quality system and insight of their processes. If the Contractor is not AS9100-certified, the Contractor shall accommodate an annual AS9100 compliance audit by NASA.**

- **The Contractor shall allow attendance of two personnel, performing insight for this contract, from NASA, other supporting federal agencies, or NASA support contractors at flight hardware acceptance reviews and make available all documentation associated with those reviews.**

- **The Contractor shall provide access to all quality information such as: audit schedules, audit reports, Material Review Board (MRB) actions and minutes, problem failure reports, discrepancy reports, test failure reports, system failure reports, anomalies, deviations and waivers, and data to support NASA insight. This may take the form of read-only access to Quality Assurance on-line (via remote terminal) or paper database systems containing this information and to which the Contractor has regular and timely input.**

- **The Contractor shall participate in the Government/Industry Data Exchange Program (GIDEP) and provide Alert System Documentation.**

SOFTWARE QUALITY ASSURANCE SYSTEM

- **For the launch vehicle, the Contractor shall define and implement a Quality Assurance System in accordance with ISO 90003:2004, Software Engineering – Guidelines for the Application of ISO 9001:2000 to Computer Software and that meets or exceeds the intent of NASA-STD-8739.8 Software Assurance Standards. For the orbital vehicle, the Contractor shall define and implement a Quality Assurance System in accordance with SSP 50808.**

- As part of the standard resupply service, the Contractor shall provide the data, documentation, drawings, analytical models, and support services as necessary to accommodate the requirements specified under Clause II.A.18, NASA Insight and Approval. The Contractor shall provide this information for launch and orbital vehicle systems, subsystems, materials, processes, and test equipment including, upon request, those used on non-NASA missions.
- The Contractor shall grant NASA insight into Launch Vehicle (LV) processing and integrated Payload/OV/LV processing.
- Prior to the first CRS mission, at or before its Vehicle Baseline Review, the Contractor shall provide to NASA key vehicle design data in accordance with DRDs C3-3, C3-4, and C3-5. Concurrently, in accordance with DRD C7-2, the Contractor shall provide to NASA one set of flight data and reports from the mission that fully demonstrated compliance with SSP 50808. If that mission is yet to be accomplished, the Contractor shall provide DRD C7-2 within 60 days of completion of that mission.
- The Contractor shall provide NASA with full-rate data and reports in accordance with DRD C7-1 and C7-2, for each mission flown by the launch vehicle or orbital vehicle regardless of the ultimate customer, to the limit that other flight data may be government classified or customer proprietary.
- The Contractor shall notify NASA of qualification or test anomalies involving ISS Commercial Resupply launch and orbital vehicles, systems, subassemblies, components, software and similar launch and orbital vehicles that the Contractor is aware of.
- In the event of an in-flight anomaly or launch, on-orbit or entry failure, the Contractor shall allow NASA to participate fully in the Contractor's Failure Investigation Board including those for non-NASA missions.
- NASA may elect to have representation as a resident office at the Contractor's major manufacturing and engineering facilities for the life of the contract. The Contractor shall provide accommodations and services, such as badging, furniture, telephones, and use of easily accessible fax, viewgraph, and copy machines for up to two residents. Two voice and two data lines shall be provided. Electronic data transfer compatibility between the resident office and off-site NASA institutions is required.

- **NASA insight and approval includes insight into any corporation, corporate divisions, subsidiaries, joint ventures, partner(s) and/or any other business entity actually performing launch or orbital vehicle manufacturing, management, orbital-to-launch vehicle integration, testing and launch.**

- **NASA will retain approval authority over portions of the resupply service that interface with ISS hardware and cargo. NASA approval is defined as providing authority to proceed and/or formal acceptance of requirements, plans, tests, or success criteria. Specific areas requiring NASA approval are related to compliance with SSP 50808 ISS COTS Interface Requirements Document (IRD), and cargo environment constraints.**

- **NASA will retain insight into other components of the resupply service in order to assess the risk to the cargo itself and to its safe and timely delivery. NASA insight is defined as gaining an understanding necessary to knowledgeably assess the risk of Contractor actions or lack thereof through observation of manufacturing or tests, review of documentation, and attendance at meetings and reviews. NASA is limiting its insight into the launch service and will not participate in the final launch countdown.**

- **While NASA insight will inform risk assessments pursuant to Clause II.A.17 above on both the Baseline vehicle and changes to that Baseline, the focus of NASA insight will be changes to that Baseline as covered in the reviews of SOW Section 2.1.1**

- **Where NASA insight is required as defined in (A) through (H) below, the Contractor shall notify the COTR and the NASA Resident Office of meetings, reviews, or tests in sufficient time to permit NASA participation through the entire event. While insight into the orbital vehicle is largely achieved through the processes of ISS integration, other specific areas to be open to NASA insight are:**
  - **Safety and Health Plan (DRD C1-4) and Mishap Notification, Investigation and Contingency Action Plan (DRD C1-2), Reliability Program and Quality Assurance Program at the time of proposal.**

Launch Vehicle Design Insight – non-recurring except for design changes

- Baseline, changes from the Baseline and Mission Unique vehicle design, analyses, and configuration management through design and qualification reviews.
- Narrowly focused reviews of the Contractor's Test Like You Fly and qualification rationale of the propulsion, flight controls, software and separation systems. If a system or component of a system is found to have caused a mission failure, the system shall be added to the areas of focused insight.

Vehicle Production Insight – recurring

- Preflight predictions of flight performance.
- Vehicle, system, subsystem, software and component performance from flight vehicle, tracking and range data, post flight data review, and flight anomaly resolutions.
- Specific production progress through production program reviews, plans, and schedules, including schedules and schedule risk of non-CRS missions.
- Problems and deviations to the design through production and test Material Review Boards, major or critical problems, anomaly resolutions, nonconformances, failure analysis, post test results, and acceptance and preship reviews.
- Safety & Mission Assurance compliance evaluations if not AS9100-certified (prime and subcontractors); updates to the Safety and Health Plan (DRD C1-4) and Mishap Notification, Investigation and Contingency Action Plan (DRD C1-2).

Should approval or insight identify non-compliance with the terms and conditions of the contract, a difference in interpretation of test results, or disagreement with the Contractor technical directions, NASA will take appropriate action within the terms of the contract to ensure compliance via written direction to the Contractor.

Notwithstanding the insight and approvals set forth in Clause II.A.18 herein, the Contractor assumes full performance responsibility as set forth in this contract, and neither NASA's insight nor its approval under this clause shall be construed as a defense to any finding of mission success or final acceptance or rejection of the resupply service.

The Contractor shall provide:

- **Documents and reports used in the development of the orbital and launch vehicle environments (acoustic, random, sine, shock) and hardware qualification.**

- **Pre-flight predictions of expected flight environments (e.g. acoustic/vibration, quasi-static acceleration, thermal, shock, and pressure).**

- **In addition to the specific information listed in this clause, the Contractor shall provide a listing of existing and planned data products, models, packages, reports, ERB packages which the Contractor or its launch service provider will/has create/d in this analysis area for their own purposes. Upon request, NASA shall be provided these items. The combination of these items and those specifically listed shall support the following NASA Assessment:**

  - **Implement and validate generic CLA (with NASA code) using Contractor or provider models and forcing functions.**
  - **Review Contractor or provider model validation.**
  - **Review Contractor or provider dynamic event selection and associated forcing function development.**
  - **Validate that frequencies, damping and modes of the launch vehicle dynamic models are traceable to ground testing.**
  - **Validate models which are not anchored in substantial flight data.**
  - **Verify system design is robust against model variations.**

In addition to the specific information listed in this clause, the Contractor shall provide a listing of existing and planned data products, models, packages, reports, ERB packages which the Contractor or its launch service provider will/has create/d in this analysis area for their own purposes. Upon request, NASA shall be provided these items. The combination of these items and those specifically listed shall support the following NASA Assessment:

- Review elements of the launch vehicle aerothermal model and validate against contractor data.
- Review elements of the thermal models of engines and solid motors and validate against contractor data.
- Validate that the aerodynamics for the launch vehicle are traceable to wind tunnel test data.
- Aerodynamic impacts on the vehicle venting analysis are well understood.
- Validate models which are not anchored in substantial flight data.
- Verify system design is robust against model variations

The Contractor shall provide:

- EMI/C environment test procedures and data,
- Antenna gain patterns,
- Transmitter characteristics (line losses, frequencies, power at a minimum),
- Radiated fields from the launch vehicle at the cargo positions,
- Range RF environment for a launch of this vehicle,
- Ordnance circuit design guidelines,
- Ordnance circuit test reports from the Demonstration mission launch vehicle, or most recent launch if the Demonstration mission has not been accomplished,
- Grounding, bonding and isolation methodology, requirements, and diagrams,
- Grounding and isolation test results from the Demonstration mission launch vehicle, or most recent launch if the Demonstration mission has not been accomplished,
- Wire routing methodology and requirements,
- Vehicle to ground station link analysis from Demonstration mission,
- Available vehicle patterns for C Band, Ultra-High Frequency (UHF), Global Positioning System (GPS) and S Band antennas. This shall include, as a minimum, vendor free space patterns,
- Radio Frequency (RF) intermodulation report – Analysis of intermodulation frequencies from vehicle.
- In addition to the specific information listed in this clause, the Contractor shall provide a listing of existing and planned data products, models, packages, reports, ERB packages which the Contractor or its launch service provider will/has create/d in this analysis area for their own purposes. Upon request, NASA shall be provided these items. The combination of these items and those specifically listed shall to support the following NASA Assessment:
  - Validate models which are not anchored in substantial flight data.
  - Verify system design is robust against model variations

The Contractor shall provide:

- **Nominal 6 DOF trajectory simulation results for the targeted insertion condition utilizing actual weights and propulsion models.**
- **Simulation predictions of nominal and 3-sigma limits for orbit elements and the associated covariance matrix.**
- **Mass to orbit performance capability, margins and reserves.**
- **Sequence of Events (SOE) and tracking coverage.**
- **Launch vehicle configuration (including mission-unique features) and weight statement.**
- **Sources, magnitude, and distribution type (e.g. Gaussian, uniform) for all trajectory and simulation with dispersions used.**
- **Definition of body-fixed coordinate systems used for launch vehicle and spacecraft.**
- **References to the sources for all payload inputs to the 6 DOF analysis.**
- **In addition to the specific information listed in this clause, the Contractor shall provide a listing of existing and planned data products, models, packages, reports, ERB packages which the Contractor or its launch service provider will/has create/d in this analysis area for their own purposes. Upon request, NASA shall be provided these items. The combination of these items and those specifically listed shall support the following NASA Assessment:**
  - **Develop launch vehicle 3DOF trajectory model.**
  - **Validate model against contractor vehicle mass and performance predictions and data.**
  - **Validates models which are not anchored in substantial flight data.**
  - **Verify system design is robust against model variations**

The Contractor shall provide:

- **Pedigree Review packages and presentations at the supplier for the launch vehicle that include a hardware summary, As Built Configuration List, Acceptance Test and Results summary, summary of discrepancies and resolutions encountered during manufacturing/testing, and summary of deviations and waivers.**

- **Verbal or written responses to NASA's Request For Information (RFI) items.**

- **Cause and effect analyses for using or replacing suspect hardware**

- **Additional data as requested (for example analysis, drawings, schematics and/or photos, hardware cross sections to resolve concerns over hardware disposition)**

- **Sub-tier vendor data as needed**

The Contractor shall provide an overview presentation of manufacturing processes & quality controls (2-6 hrs) including:

- **Manufacturing Process Review**
  - **Documentation: Requirements and Traceability**
  - **Nonconformances, Rework, and Rebuilds: Initiation, Documentation, Verification, Drawing changes, and Rejection procedures and disposition**
  - **Personnel Training**
- **Pedigree Review Process**
  - **Acceptance and qualification standards**
  - **Lot acceptance policies (as applicable)**
  - **Subcontractors and Vendors**
    - » **Vendor certification requirements**
    - » **Material and parts inspection**
    - » **Subcontractors used**
    - » **Problem tracking**
    - » **Subcontractor performance review reviews**
- **Quality Control**
  - **Metrology and calibration**
  - **Foreign Object Debris (FOD) control (as appropriate)**
  - **Environmental controls, to include control of potentially damaging materials**
  - **Clean room policies (as applicable)**
  - **Problem tracking (trends and frequent occurrences): Internal, Vendors, Industry wide**
- **Production schedules: Manufacturing schedules for relevant parts, Maintenance policies for heavy manufacturing equipment, Inventory dynamics**

The Contractor shall provide:

- **Production Line Inspection (2-5 hours)**
  - Tour of manufacturing processes for relevant parts, including as many steps as practical, with parts inspections where practical
  - The opportunity to inspect representative documentation pertinent to the launch vehicle, including:
    » Build instructions
    » Nonconformance documentation
    » Calibration stamps and/or tags
    » Parts traceability
  - Opportunities for questions on the floor
- **Close-out question and answer session (2-4 hours):** This meeting will include the opportunity for NASA to ask questions arising from the overview and production line inspection. NASA shall have the option to request additional information that would provide additional confidence in the vendor's production repeatability and completed hardware meeting the design intent. In addition to Requests for Information (RFIs) handled on-site, some RFIs might required additional time for the vendor to respond. Written responses to NASA's request from the vendor not given on-site shall be handled in a timely fashion, normally delivered within two weeks, except where not possible due to critical schedule restrictions.
- **NASA review of additional documentation (2-4 hours):** The vendor shall provide a conference room for the NASA team to perform documentation review during after the close-out question and answer session.

In meetings at the design engineering, manufacturing and launch sites, the Contractor shall provide presentations, and documents as required, defining and describing the processes for performing, tracking, and recording of the vehicle flight hardware/software integration, test and checkout. The processes will cover the generation, control, and disposition of test procedures, nonconformance, and failure analysis. The Contractor shall make available to NASA all problem reports or discrepancy reports on launch vehicle systems' failures and anomalies for the Demonstration mission, or the most recent mission if the Demonstration mission has not yet flown.

The Contractor shall provide launch vehicle fishbones using a cause and effect analysis addressing all possible root causes of mission loss, for flight and ground subsystems.

The Contractor shall provide a disposition for each fishbone; including engineering changes, mitigation, conclusions, recommended actions and reports.

- The completed analysis shall include closures describing mitigating factors that protect against the subject root cause.
- The top level of the analysis shall incorporate the primary elements of man, method, machine, material and measurement.
- Hardware detail shall be to the box level (e.g. flight computer, regulator, thrust vector control actuator, hydraulic pump, etc).
- Mission analysis level shall be to the design analysis level (e.g. coupled loads, autopilot stability, integrated thermal analysis, guidance accuracy analysis, etc.).
- Fault trees and/or Failure Mode Effects Analyses (FMEAs), if they exist, will be provided for items without fishbones. Additional information on failure modes and/or mitigation may be required for these items, specifically the consideration of failure causes rooted in human error and/or analytical methods.

The Contractor shall make available launch vehicle engineers in the appropriate engineering areas for occasional discussions at the system and sub-system level: mechanical, electrical, S&MA, flight design, flight software, controls, loads, environments, stress, thermal and EMC/RF.

The Contractor shall provide documents and/or schematics defining the operation of the launch site Ground Support Equipment systems. Emphasis will be placed on launch system and launch complex structural, mechanical, fluid and electrical ground to vehicle interfaces. Payload Environmental Control System (ECS) system maintenance, testing, calibration and/or metrology, and operation during all phases of payload processing at the launch complex will be included. Examples of support equipment include, but are not limited to, ground computer, ground software, communications system, ECS, lifting equipment, safe and arm securing system, power distribution system, battery simulators, and test tools.

8610.7C Stoplight Summary

John F. Kennedy Space Center

LAUNCH SERVICES PROGRAM

8610	7C	1	a		Utilize existing and emerging LV	
			b		Utilize American LV	
			c		LV assignment is consistent with risk	
			d	1	LV definition	
				2	Class D payload on Category 1 LV	
				3	Class B-C payload on Category 2 LV	
				4	Class A-B payload on Category 3 LV	
				5	Flight history applicable to certification	
				6	Higher risk payloads can use lower risk LV	
				7	FPB approval for Delivery On Orbit	
				8	Use of Foreign LV	
				9	Certification is required	
				10	Use of a Department of Defense launch	
		2	a		Applicability to NASA payloads	
			b		Non-applicability to Shuttle	

Station · **LSP** · **Contractor** · **Not Applicable** · **Not Followed**

Sensitive But Unclassified.

8610.7C Stoplight Summary

8610	7C	5	a		AAA-LS responsibilities
				1 (Station)	FPB risk class and LV assignment approval
				2 (Not Applicable)	Tailored certification approach approval
				3 (Not Followed)	Enforcement of this policy
				4 (Not Applicable)	Coordinating foreign LV exemption
				5 (LSP)	Alternate risk mitigation strategies
		5	b		AA responsibilities
				1 (LSP)	AO and RFP consistency with this policy
				2 (Not Followed)	8705.4 payload risk classification
				3 (LSP)	Serve on the Flight Planning Board
		5	c		LSPM responsibilities
				1 (Not Applicable)	Develop certification requirements
				2 (Not Applicable)	Cite major LV modifications
				3 (Not Applicable)	LS solicitation consistency with this policy
				4 (Not Applicable)	Change certification requirements
				5 (Contractor)	Safety and mission success of LS

Legend:
- Station (Blue)
- LSP (Green)
- Contractor (Yellow)
- Not Applicable (Gray)
- Not Followed (Red)

8610.23C Stoplight Summary

8610	23C	1			Policy
			a		NASA accountability for launch
			b		Technical oversight approach (baseline)
			c		NASA involvement and control of launch
			d		Monitoring of metrics and milestones
			e		Formal ATP and acceptance for approvals
		2			Applicability – "modified oversight approach"
		5			Responsibility
			a		Space Operations AA responsibilities
			b		AAA-LS responsibilities
				1	Assessing LSP implementation
				2	FPB approval to deviate from policy
				3	Consult with General Counsel for FAA applicability under reduced oversight
				4	Assess applicability to Delivery On Orbit
				5	Tailoring policy through Flight Planning Board

Legend:
- Station (blue)
- LSP (green)
- Contractor (yellow)
- Not Applicable (gray)
- Not Followed (red)

8610.23C Stoplight Summary

Legend
Station
LSP
Contractor
Not Applicable
Not Followed

					Description
8610	23C	5	c		LSP Manager responsibilities
			1		Resolution of technical issues
				i	Completely identified, addressed and coordinated with spacecraft customer
				ii	Elevation when unresolved
			2		Launch Services Contracts
				i	Include insight and approval rights and requirements
				ii	Permit independent verification & validation
				iii	Permit NASA approval of mission-unique items
				iv	Permit substantial involvement in, control of and approval by NASA of final go for launch
				v	Permit NASA Safety & Mission Assurance processes
				vi	Safety, statutory and regulatory requirements
				vii	Safety and mission success of the Launch Service
				viii	Telemetry for all powered flight
			d		Other Mission Directorates' AA responsibilities

Spacecraft-to-launch vehicle interface control documents/drawings.	Contractor
Decisions/resolutions of action items as determined by joint NASA/contractor Mission Integration Teams.	Not Applicable
Mission-unique hardware & software design, analysis, manufacture, & test.	LSP-2
Baseline and changes to Contractors Risk Management, Quality Management, and Systems Effectiveness Plan/Approach, consistent with the intent of NPD 1280.1, NPR 7120.5, and NPR 8715.3.	SMA-6
Top-level test plans, requirements, and success criteria for Integrated Vehicle Systems and for tests that verify the integrated vehicle interfaces.	Contractor
Launch commit criteria.	Contractor
Closeout of actions from NASA-Chaired Mission and FRRs.	Station
Spacecraft-handling procedures and deviations.	Station
Integrated spacecraft/vehicle mate, test & closeout procedures & deviations.	Station
Launch countdown procedures and deviations that affect spacecraft/vehicle integrated assembly.	Station
Anomaly resolutions that affect the integrated assembly.	SMA-6
Launch Go/No-Go.	Contractor

1. Baseline vehicle design, analyses, models, and configuration management.	LSP-2,3
2. Production program reviews, plans, and schedules.	Station
3. Production and systems test and Material Review Boards.	SMA-6
4. Critical flight hardware pedigree.	SMA-6
5. Safety and Mission Assurance compliance evaluations (prime and subcontractors).	SMA-6
6. Pre-ship reviews.	Contractor
7. Design and qualification reviews.	SMA-6
8. Major/critical problems.	SMA-6
9. Major system and integrated systems tests.	Contractor
10. Post-test data.	Contractor
11. Anomaly resolutions.	SMA-6

12. Failure analysis.	SMA-6
13. Vehicle/ground support equipment procedures.	Contractor
14. Launch site support work schedules and plans.	Station?
15. Launch site vehicle preparations and closeout data.	Contractor
16. Vehicle walk-down inspections.	Contractor
17. Operations and procedure discipline.	Contractor
18. Work practices and documentation.	SMA-6
19. Conduct of contractor-chaired Mission, Launch & Flight Readiness Reviews	SMA-6
20. Postflight vehicle, tracking, and range data.	LSP-1
21. Postflight anomaly investigations/closeouts.	LSP-1

8610.24B Stoplight Summary

LAUNCH SERVICES PROGRAM

					Description
8610	24B	1	**a**		Rationale for prelaunch reviews
			b	**1**	NASA Launch Vehicle Readiness Review
				2	NASA Flight Readiness Review
				3	NASA Launch Readiness Review
				4	NASA Final Commit-to-Launch Poll
			c		Authority for other appropriate reviews
			d		Parallel spacecraft reviews
		2			Applicability
		5			Responsibility
			a		AA-SO and AAA-LS: LV readiness certification
			b		LSP Manager signs COFR
				1	LVRR coordination
				2	NASA Advisory Team establishment
			c		Spacecraft Mission Director responsibilities
			d		NLM responsibilities
				1	FRR and LRR coordination
				2	All representatives sign COFR
				3	Premishap plan coordination
				4	Conducting Final Commit-to-Launch Poll

Legend:
- **Station** (blue)
- **LSP** (green)
- **Contractor** (yellow)
- **Not Applicable** (gray)
- **Not Followed** (red)